

default value $S_i(t_i)$ of the transmission power. A limitation must be naturally attached to formula (2), according to which the value $S(t)$ of the new transmission power must be between the minimum and maximum values determined for the terminal device. There are two kinds of minimum and maximum power limits: fixed limit values depending on the construction of the terminal device and limits per cell determined by the network that often change from one cell to another. In a very small cell the base station forbids the terminal devices on the area of the cell to transmit with a power that is higher than a certain power limit. The prohibition is transmitted to the terminal devices as signaling in a way known in the art.

On possible form of function f is a function approaching exponentially the value $S_i(t_i)$

$$S(t) = S_i(t_i) + (S_c(t_c) - S_i(t_i)) * e^{-\alpha(t-t_c)} \quad (3)$$

wherein α is a positive parameter, the most suitable value of which can be found by testing.

The terminal device stores the power value $S(t)$ into the memory and transmits the bursts that carry the blocks of the next packet by using the transmission power $S(t)$. After having received the next acknowledgment message and when preparing to transmit the following packet, the terminal device calculates again a new power value. In an alternative embodiment, the terminal device can in the "Continuous" state take a certain number of the latest power values into consideration and not only the last one. In a further alternative, the terminal device can increase the value $S(t)$ of the transmission power towards the highest permissible transmission power S_{max} , insofar, as how many times a certain frame or packet has been retransmitted already. The retransmissions are usually due to data transfer errors that can be avoided by increasing the transmission power.

If more time than a certain predetermined time limit has passed from the reception of the latest acknowledgment, the feedback information included in the acknowledgment loses its validity and it is no use for the terminal device correcting the transmission power according to the closed-loop control, because there is a great probability of a control error. In that case the next transmission power will be determined by formula 1, in other words, the terminal device has returned, according to the markings of FIG. 1, back to the "Initial" state. Mathematically this corresponds for the part of the exemplified function, that in formula (3), the term $(S_c(t_c) - S_i(t_i)) * e^{-\alpha(t-t_c)}$ is insignificantly small.

In the changes of the transmission power, it is advisable to use a certain marginal factor, which means the biggest permissible single change of the transmission power, and the size of which is e.g. 2 dB. By using the marginal factor the oscillation of the power levels is tried to be prevented. Namely, fast and big changes of the power level cause correspondingly quick changes in the so called cochannel interferences that have influence on the operation of cells located near each other on the same or adjacent frequencies. A fast and big change causes first a corrective reaction in the other, near located cell, and that corrective reaction, in turn, reflects back to the original cell as a cochannel interference, whereby the system can become unstable.

The marginal factor M can have a standard size or it can be adopted to the size of the packet to be transmitted respectively: as in the transmission of long packets acknowledgments are transmitted seldom and corresponding corrections of transmission power are seldom made, the corrections can be bigger (factor M can be bigger) than when transmitting short packets. In circuit switched GSM links the transmission power control is made in steps of 2 dB every

60 seconds on a 30 dB wide range. So, a known GSM terminal device can change power from one boundary value of the permissible range to another in about one second. If the packets to be transferred in the GPRS have the length of max. three blocks, the marginal factor M can be 2 dB. With longer packets, anyway, with the maximum length of 8 blocks, the value of M can be 4 dB and in case of extremely long packets (e.g. of 80 blocks) the marginal factor M can be as big as 30 dB.

If the data transfer network does not provide at all the quality information measured by the base station in its reception, the terminal device uses automatically only the open-loop control. With the parameters carried by the network, the time limit after which the terminal device moves from the "Continuous" state to the "Initial" state, can be set substantially to infinite, whereby the terminal device is the whole time in "Continuous" state, but the ratio between the power value calculated based on acknowledgment information and the one calculated by the open-loop principle depends on the parameters of formula (3) or some other function used for this purpose. The power level of the first transmission in the control of the pure closed-loop type can be set e.g. as the maximum power by using the maximum value of the target level T_0 .

The data transfer network can transmit all the parameters having effect on the power control through the base stations as transmissions of broadcast type to all terminal devices. In that case the control of the power control is kept in the network, although the running of the power control algorithm is effected in the terminal devices.

The transmission power control in accordance with the present invention has been described above in a terminal device of a cellular radio system. In the following we deal with the application of the method to the transmission power control in a base station of the cellular radio system. As stated in the description of the prior art, the power control in the base station has not as significant a meaning as in the terminal device, in which the power consumption is tried to be minimized in every possible way. The base station can not use any regular BCCH or PBCCH type transmission from the terminal device, so it can't base the open-loop control on the same algorithm as the terminal device. There are two alternatives in the method in accordance with the invention. The base station can either use the maximum power determined to it always when starting transmission of packets, or it can maintain the certain power value saved into the memory in connection to an earlier transmission of packets and use it as such or modulated by certain defaults. One default of that kind is that the longer the time is that has passed from the transmission of the previous packet, the bigger is the probability that the terminal device has moved significantly, whereby the circumstances can have changed to more disadvantageous requiring a bigger transmission power. In that case the earlier power value saved into the memory of the base station will be corrected with regular intervals bigger, until it corresponds the maximum transmission power determined for the base station.

In the closed-loop type control, the base station receives from the terminal device an acknowledgment according to the RLC level, when the terminal device has received a certain packet. The number of bursts required for the transmission of one packet ranges from four to several hundreds of bursts. The terminal includes in the acknowledgment message information on the average quality level in the bursts of the received packet. The base station system or the base station controller calculates the power value $S_c(t_c)$ in the same way as described above about the operation of the